

9.45 p. m. Although the moon was full, the display was very distinct.

The following report is taken from "Nature" of June 7, 1883:

"On May 19th, at about 10 p. m., a remarkable aurora-borealis was observed at Ludvika, in Sweden. It began as a faint band of light parallel with the horizon, which gradually grew broader and broader. The extraordinary feature of the phenomenon was, however, that this band had the appearance of an ice-covered lake on which the moon was shining. Promontories and shores covered with trees were seen, and also the faint outlines of farms. This phenomenon lasted about ten minutes, when the aurora changed into a suffused pink luminosity, like that of clouds near the setting sun."

20th.—Escanaba, Michigan: straw colored auroral beams were observed in the northern sky after 10 p. m. This display was also observed at Billings, Montana; Humboldt, Iowa; and at the following stations in Minnesota: Moorhead, Northfield, Saint Paul, and Saint Vincent.

21st.—Traverse City, Michigan.

25th.—Ithaca, New York; Sutton, Nebraska.

26th.—Sutton and Red Willow, Nebraska.

27th.—New Haven, Connecticut: a faint aurora was observed in the northern sky from 8 to 11 p. m.

THUNDER-STORMS.

Thunder-storms were reported in the various districts on the following dates:

New England.—8th, 10th, 11th, 14th, 15th, 21st, 22d, 23d, 28th, 29th, 31st.

Middle Atlantic states.—4th, 5th, 7th to 11th, 14th, 15th, 20th, 21st, 22d, 26th to 29th, 31st.

South Atlantic states.—1st, 5th, 9th, 11th, 12th, 14th, 15th, 20th, 21st, 27th, 31st.

Florida peninsula.—1st, 6th, 7th, 13th, 15th, 18th, 29th, 30th, 31st.

Eastern Gulf.—1st, 4th, 9th, 10th, 11th, 14th, 15th, 20th, 26th, 29th, 30th, 31st.

Western Gulf.—3d, 4th, 9th, 10th, 12th, 14th, 17th to 20th, 25th, 26th, 28th, 29th, 30th.

Rio Grande valley.—3d, 4th, 10th, 16th, 17th, 25th, 30th.

Ohio valley and Tennessee.—1st, 3d, 4th, 5th, 7th, 9th, 10th, 11th, 14th, 15th, 17th to 21st, 25th to 31st.

Lower lakes.—1st, 3d, 4th, 5th, 7th, 8th, 10th, 14th, 19th to 22d, 24th to 28th.

Upper lakes.—2d, 3d, 4th, 6th, 7th, 9th, 10th, 13th, 14th, 15th, 18th, 19th, 24th, 25th, 27th, 28th, 30th.

Extreme northwest.—16th, 17th, 24th, 26th, 29th.

Upper Mississippi valley.—1st to 4th, 6th to 10th, 13th to 20th, 23d to 30th.

Missouri valley.—1st, 2d, 3d, 6th to 13th, 16th, 17th, 18th, 23d to 31st.

Northern slope.—1st, 7th, 8th, 11th, 12th, 13th, 15th, 16th, 17th, 21st to 25th, 27th, 28th, 31st.

Middle slope.—1st, 6th, 8th, 12th, 13th, 16th to 19th, 22d to 25th, 28th, 31st.

Southern slope.—4th, 6th, 9th, 11th, 16th, 18th, 19th.

Southern plateau.—12th, 13th, 16th, 31st.

Middle plateau.—7th, 10th, 11th, 12th, 24th, 31st.

Northern plateau.—6th to 13th, 20th, 21st, 24th.

Thunder-storms were also reported from the following states not included in the districts named above:

California.—Benecia Barracks, 6th; Fort Bidwell, 7th; Sacramento, 6th; San Francisco, 11th; Red Bluff, 13th; Visalia, 6th, 10th.

Oregon.—Portland, 10th; Roseburg, 11th.

The following are the most noteworthy instances of damage by lightning that have occurred during May:

On the morning of the 3d, the barge "C. F. Allen," while lying at Muskegon, Michigan, was struck by lightning and burned nearly to the water's edge. The lightning struck the foretopmast and passed down the wire rigging into the hold, setting fire to her cargo of lumber. The barge and cargo are a complete loss. The damage is estimated at \$7,000.

Omaha, Nebraska, 8th.—During a heavy thunder-storm on

the morning of this date, the telephone office and several other buildings in this city were badly damaged by lightning.

Cedar Rapids, Linn county, Iowa, 9th.—The Union depot was struck by lightning a 3 p. m. of this date, and was partially destroyed.

Lebanon, Saint Clair county, Illinois, 14th.—About four miles north of this place, a barn in which were stored grain, hay, and farming implements, was struck by lightning and consumed.

Jersey City, New Jersey, 10th.—At 3.30 a. m., of this date, an oil tank in the National Storage company's works, at Communipaw, was struck by lightning. A terrific explosion followed, which was heard for miles around. The fire spread rapidly and was not under control for several hours. During the afternoon and early evening, about one and one-half miles of water were covered by the burning oil. The flames consumed everything on seven acres of ground. This conflagration resulted in the loss of eight lives, and the destruction of the following property: twelve oil tanks, each containing 20,000 barrels of crude oil; two large storage houses, containing 1,500 barrels of oil; eighteen cars; three docks; six unloaded barges; three small brick buildings; and the engine room, office, and machine shops. The total loss is estimated at \$1,500,000.

New York City, 9th.—A sash and blind factory in this city was struck by lightning on this date, causing damage to the stock and building, estimated at \$19,000.

Jamaica, Long Island, 14th.—During a violent thunder-storm which passed over this place between 10 and 11 p. m., the lightning caused much damage at various points on Long Island. At Springfield, a residence was damaged to the extent of \$15,000, and all of the inmates were severely injured. At Foster's Meadow, a barn containing hay, grain, farming implements, horses, and cattle was destroyed. Other damage was done at Washington Square and South Woodhaven.

OPTICAL PHENOMENA.

SOLAR HALOS.

Solar halos have been observed in the various districts on the following dates:

New England.—1st, 6th, 8th, 12th, 13th, 14th, 16th, 18th, 19th, 30th.

Middle Atlantic states.—1st, 2d, 3d, 5th, 7th, 8th, 11th, 13th, 14th, 15th, 17th, 18th, 19th, 25th, 28th, 29th.

South Atlantic states.—5th, 11th, 12th, 13th, 18th, 19th, 25th.

Eastern Gulf.—3d, 4th, 12th, 16th, 19th, 20th, 24th, 25th, 27th.

Western Gulf.—1st to 4th, 9th, 13th, 15th to 19th, 22d, 24th to 28th.

Ohio valley and Tennessee.—3d, 4th, 6th, 10th, 12th, 13th, 14th, 16th, 17th, 19th, 24th, 25th, 28th, 29th.

Lower lakes.—1st, 3d, 4th, 8th, 9th, 13th, 14th, 15th, 17th, 18th, 19th, 25th to 28th.

Upper lakes.—1st, 3d, 6th to 9th, 11th, 13th, 15th, 17th, 24th, 25th, 26th.

Extreme northwest.—1st, 2d, 5th, 14th to 17th, 23d.

Upper Mississippi valley.—1st, 3d, 7th, 10th, 12th, 13th, 16th, 18th, 22d to 25th, 27th, 28th.

Missouri valley.—3d, 5th, 6th, 7th, 15th, 17th, 20th, 23d to 28th, 31st.

Southern plateau.—2d, 3d, 11th.

Middle plateau.—4th, 9th, 10th, 14th, 16th, 21st, 23d.

Northern plateau.—4th, 9th, 14th, 20th, 22d, 24th to 27th, 31st.

North Pacific.—10th, 20th, 21st, 22d, 31st.

Middle Pacific.—2d to 7th, 9th, 10th, 11th, 13th, 14th, 17th, 21st, 22d, 26th, 27th, 28th, 31st.

Solar halos were also observed at the following stations not included in the district named above:

Pike's Peak, Colorado, 10th; West Las Animas, Colorado, 10th; Punta Rassa, Florida, 24th; Terry's Landing, Montana, 17th; North Platte, Nebraska, 5th; Red Willow, Nebraska, 3d, 5th, 7th; Eagle Pass, Texas, 24th.

LUNAR HALOS.

Lunar halos have been observed in the various districts on the following dates:

New England.—11th, 15th, 17th, 18th, 19th.

Middle Atlantic states.—1st, 11th, 13th, 14th, 17th to 21st, 25th, 29th, 30th.

South Atlantic states.—11th, 13th, 16th, 17th, 19th, 20th.

Florida peninsula.—10th, 13th, 14th, 17th, 19th, 20th, 22d, 24th, 27th.

Eastern Gulf.—12th, 14th, 16th, 19th, 25th.

Western Gulf.—10th to 16th, 18th, 21st to 24th.

Ohio valley and Tennessee.—4th, 9th, 14th, 16th to 20th, 24th, 25th.

Lower lakes.—13th, 15th, 17th, 18th, 19th, 28th.

Upper lakes.—2d, 13th, 14th, 17th, 18th, 21st, 23d.

Upper Mississippi valley.—12th, 14th, 15th, 16th, 18th, 22d, 24th, 29th.

Missouri valley.—11th, 15th, 16th, 23d, 24th.

Northern slope.—14th to 17th, 20th, 22d.

Middle plateau.—15th, 16th, 18th, 21st.

Lunar halos were also observed at the following stations not included in the districts named above: Tucson, Arizona, 22d; Yuma, Arizona, 15th; Sacramento, California, 11th; San Francisco, California, 13th; Visalia, California, 10th; Fort Stevenson, Dakota, 13th, 14th; Saint Vincent, Minnesota, 13th, 14th, 19th; Santa Fé, New Mexico, 22d; Eagle Pass, Texas, 13th, 15th, 21st; Uvalde, Texas, 15th; Spokane Falls, Washington Territory, 21st.

MIRAGE.

New Haven, Connecticut, 3d.—During the afternoon mirage was observed on Long Island sound, objects appearing elevated and inverted. Faulkner's Island light-house appeared to be resting on the surface of the water, while the base of the island seemed to be floating in the air at an elevation of one hundred feet.

Cape May, New Jersey, 8th.—Mirage was observed from 3 to 4 p. m. Vessels with inverted images appeared at elevations of from fifty to seventy-five feet and were distinctly seen at a distance of ten miles. The Brandywine light-house, eight miles distant, appeared as three structures, one above the other, the second being inverted and the top one apparently one hundred and fifty feet high.

Buffalo, New York, 10th.—At 6.15 p. m. the trees on the Canadian side of the river appeared several degrees above the horizon.

Alexandria, Dakota, 6th, 21st.

Pretty Prairie, Kansas, 4th, 7th.

Indianola, Texas, 6th, 11th, 12th.

MISCELLANEOUS PHENOMENA.

SUNSETS.

The characteristics of the sky, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal-Service stations. Reports from one-hundred and seventy-two stations show 5,306 observations to have been made, of which eight were reported doubtful; of the remainder, 5,298, there were 4,503 or 85.0 per cent., followed by the expected weather.

METEORS.

Johnson, Nemaha county, Nebraska.—At 8.30 p. m. of the 5th, a bright meteor was observed about 15° south of the zenith. It passed nearly due north and disappeared at a point about 30° north of the zenith. The meteor was apparently about the size of a man's head, with a bright yellow nucleus surrounded by a reddish tinge.

Little Rock, Arkansas.—A brilliant meteor of violet color was observed here at 8.15 p. m. of the 14th. It first appeared at a point near the zenith, and moved in a northwesterly direction. Before disappearing the meteor separated into two parts, both of which remained visible for about one second.

Nashville, Tennessee.—At 11.16 p. m. of the 16th, a bright meteor of deep blue color was observed to pass from the zenith toward the southeastern horizon. Another brilliant meteor was seen at this station at 9.45 p. m. of the 26th.

Meteors of less brilliancy were seen at the following stations: Bethel, Connecticut, 11th.

Ames, Iowa, 12th.

Cedar Rapids, Iowa, 31st.

Woodstock, Maryland, 6th, 25th, 31st.

Rowe, Massachusetts, 25th.

Lansing, Michigan, 2d, 3d.

Visalia, California, 2d, 17th, 23d, 26th, 27th, 28th, 31st.

SUN SPOTS.

The following record of sun spots for the month of May, 1883, has been forwarded by Mr. D. P. Todd, Director of the Lawrence Observatory, Amherst, Massachusetts:—

Date— May, 1883.	No. of new		Disappeared by solar rotation.		Reappeared by solar rotation.		Total No. visible.		Remarks.
	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	
1, 7 a. m.	0	2	0	0	0	0	3	10	
2, 10 a. m.	0	0	0	0	0	0	3	7	
2, 5 p. m.	0	0	0	0	0	0	3	7	
3, 5 p. m.	2	3	0	0	1	1	2	10	
6, 2 p. m.	0	3	0	0	0	0	2	7	
7, 9 a. m.	0	0	0	0	0	0	2	9	
8, 9 a. m.	0	0	0	0	0	0	2	9	
10, 5 p. m.	2	5	0	0	2	5	4	14	{ Spots probably reappear-
11, 5 p. m.	0	2	0	4	0	0	4	12	ed by solar rotation.
12, 10 a. m.	0	1	0	2	0	0	4	9	
13, 11 a. m.	0	0	1	2	0	0	3	7	
14, 10 a. m.	1	5	0	0	0	0	4	12	
16, 10 a. m.	0	0	1	2	0	0	3	10	{ Spots probably disappear-
17, 10 a. m.	1	2	0	0	0	0	4	11	ed by solar rotation.
18, 10 a. m.	0	0	0	0	0	0	4	11	
19, 4 p. m.	1	3	0	2	0	0	5	12	
24, 7 a. m.	1	2	0	0	1	2	1	2	{ Spots probably reappear-
25, 10 a. m.	0	0	0	0	0	0	0	0	ed by solar rotation.
26, 11 a. m.	0	0	0	0	0	0	0	0	
27, 2 p. m.	0	0	0	0	0	0	0	0	
28, 11 a. m.	0	0	0	0	0	0	0	0	No faculae.
29, 4 p. m.	1	1	0	0	0	0	1	1	do.
30, 10 a. m.	0	0	0	0	0	0	1	1	
31, 10 a. m.	1	3	0	0	1	2	2	4	

Faculae were seen at the time of every observation, unless otherwise indicated.

EARTHQUAKES.

Helena, Montana, 4th.—A slight shock of earthquake occurred at this place at about 11.45 a. m., the wave moving from east to west. It affected the public school building, producing a rocking motion, and causing some alarm among the pupils. Houses in several parts of the city experienced the shock.

Catlettsburg, Boyd county, Kentucky.—Two distinct shocks of earthquake were felt at this place at 11.30 p. m. of the 22d.

The following extract is taken from "Nature" of May 10th, 1883: "A strong earthquake shock, with an undulating motion, was felt at Biancaville, Sicily, on the morning of the 8th."

Victoria, British Columbia.—A severe shock of earthquake was felt at this place during the night of the 10th. The movement was from north to south.

The barge "Inga," Captain Olsen, commanding, which arrived at New York June 1st, from Padang, Sumatra, reported that on February 14th, 1883, while eighty-four miles north-northwest of the island of Engauo, an earthquake shock was felt. The vessel trembled, and the sea became a white foam, like the breaking of a school of fish. There was no wind at the time.

SAND-STORMS.

Fort Garland, Colorado, 29th.

Fort Union, New Mexico, 6th.

Yuma, Arizona, 6th, 12th, 13th, 14th, 16th.

San Carlos, Arizona, 12th.

POLAR BANDS.

West Washington, District of Columbia, 17th.

Guttenburg, Iowa, 22d.

Yates Centre, Kansas, 22d, 25th, 27th.

Gardiner, Maine, 13th, 14th.

Somerset, Massachusetts, 26th.